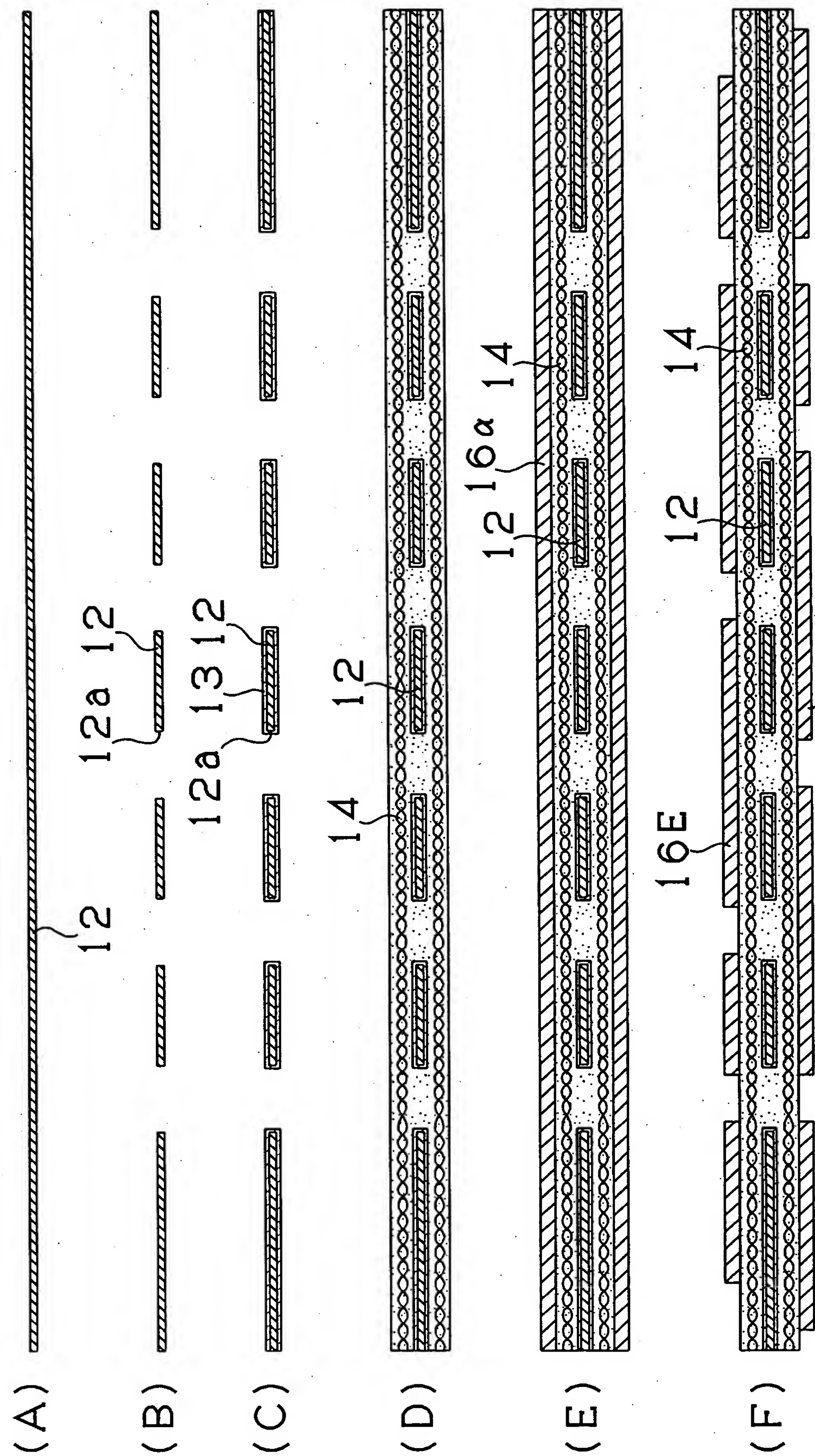
Fig. 1



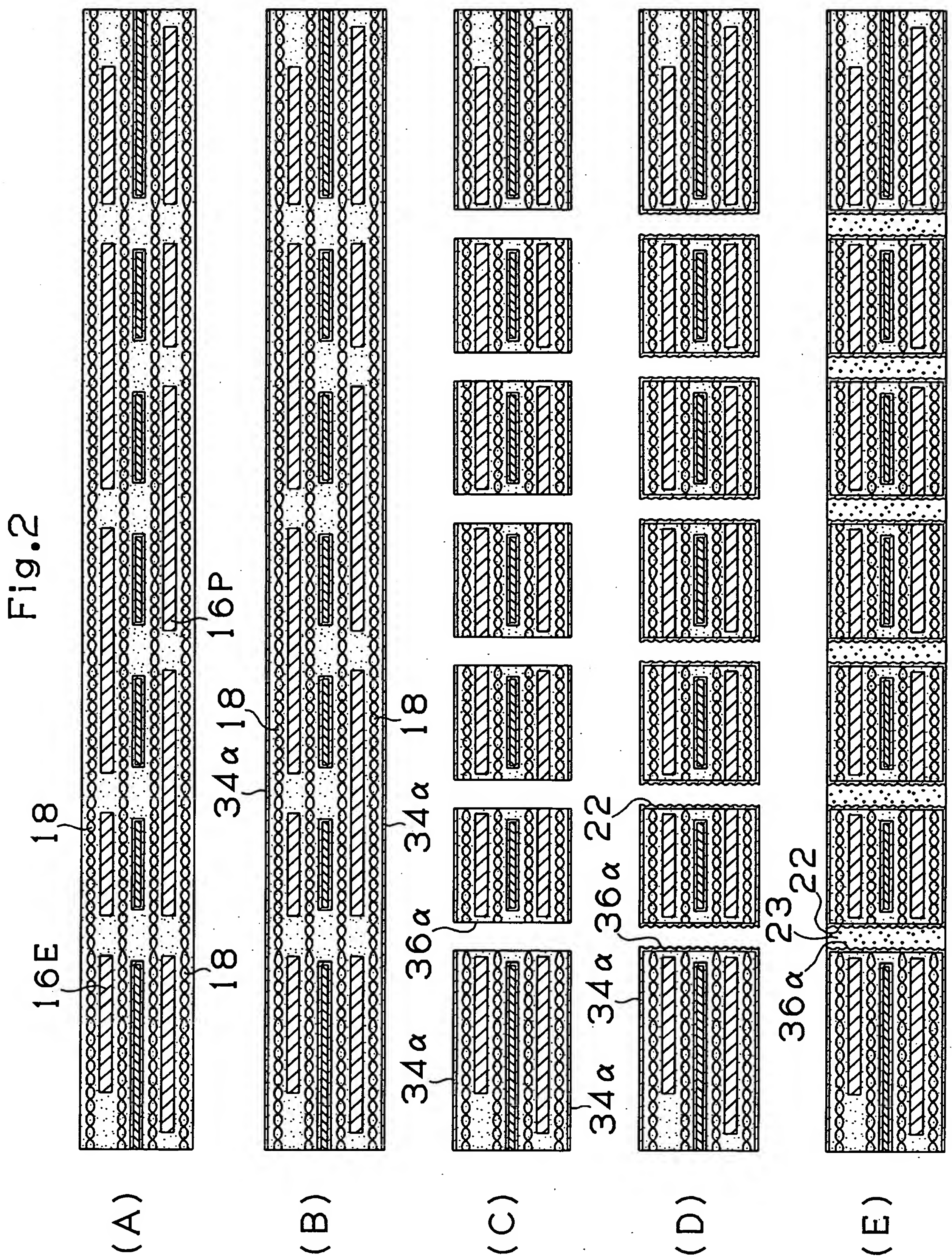


Fig.2
16E
18
16P
34α
36α
22
23
(A)
(B)
(C)
(D)
(E)

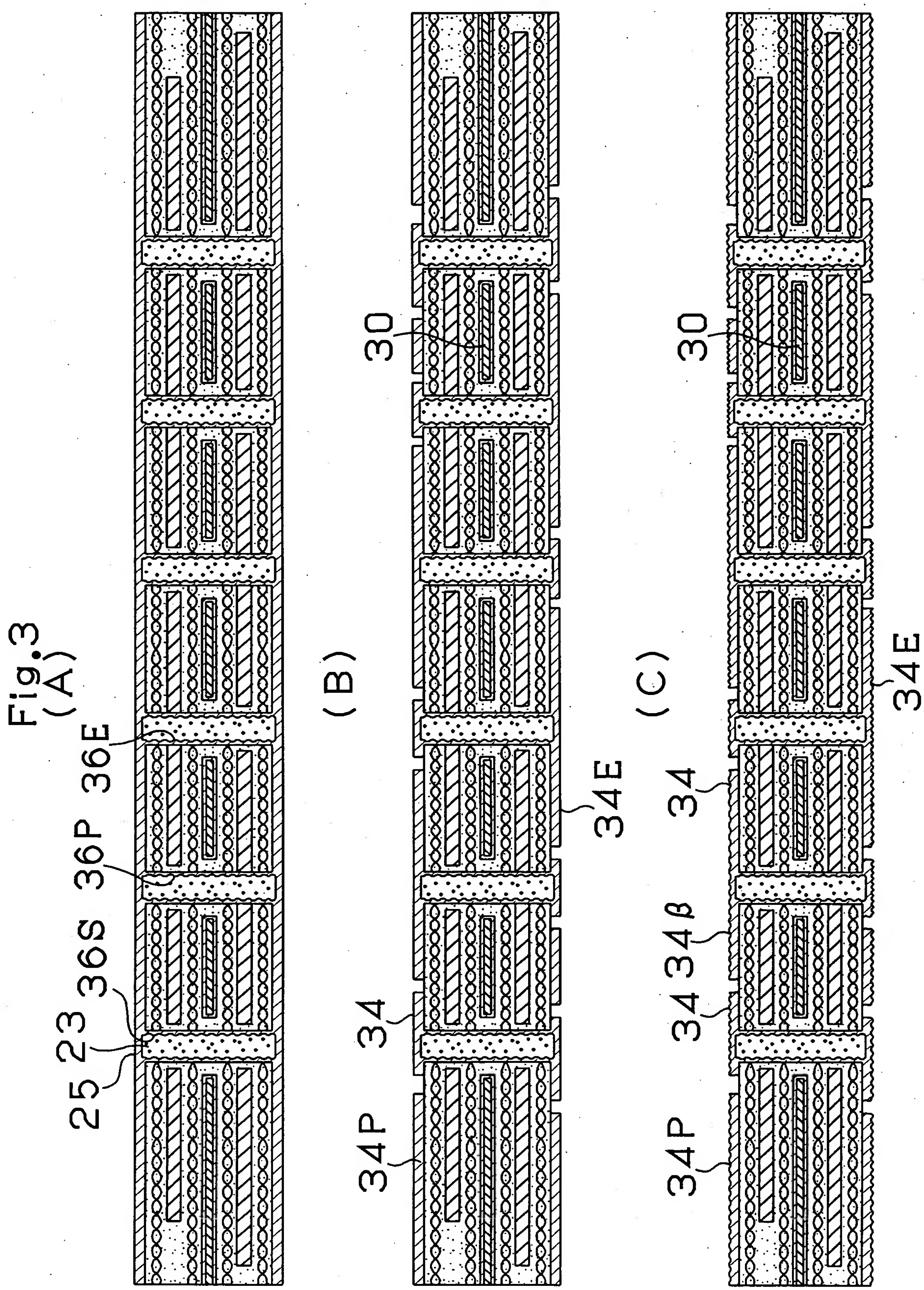


Fig.3
(A)
36E
36P
36S
23
25
(B)
30
34E
34
34P
(C)
30
34E
34
34β
34
34P

Fig.4

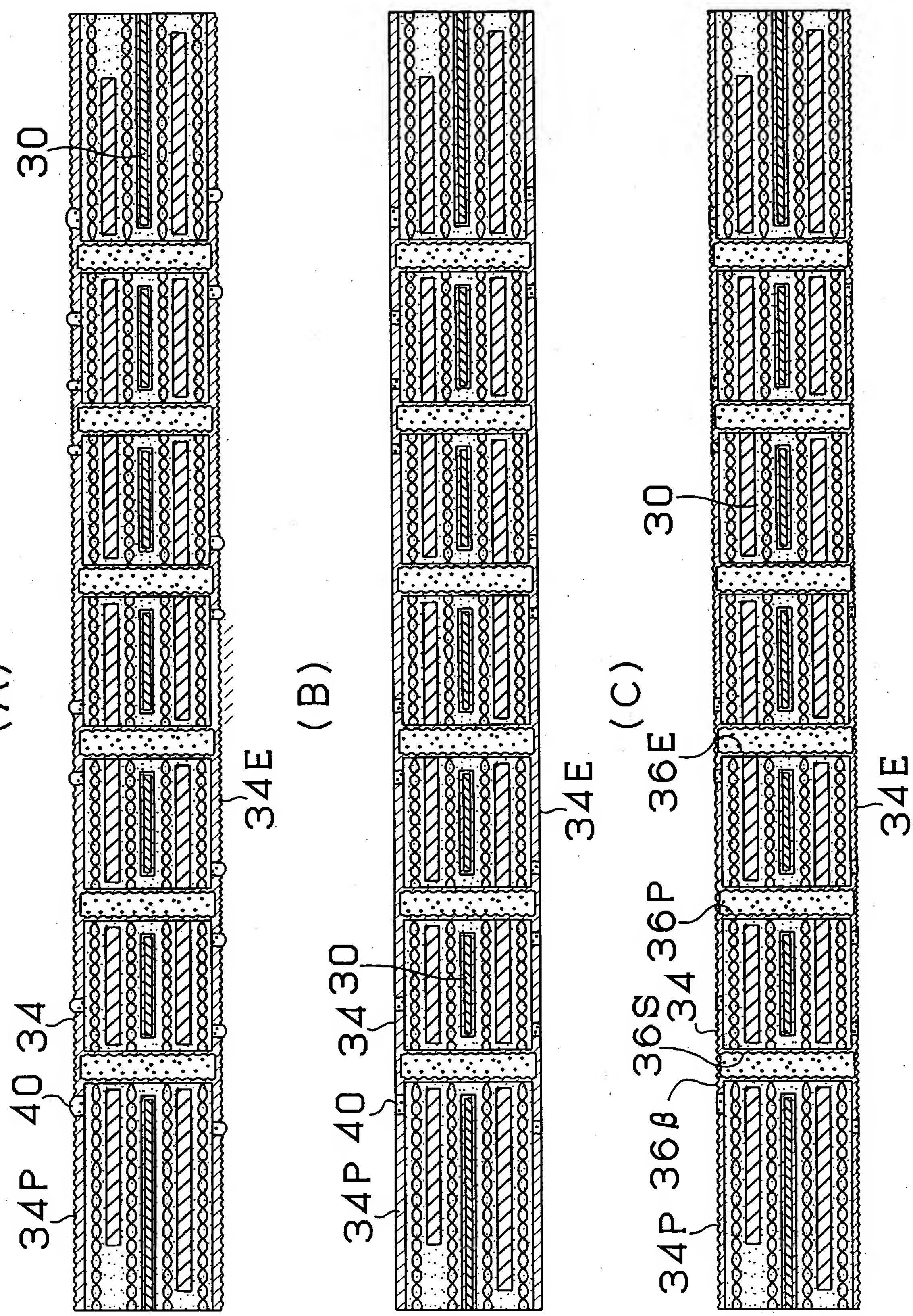


Fig.5

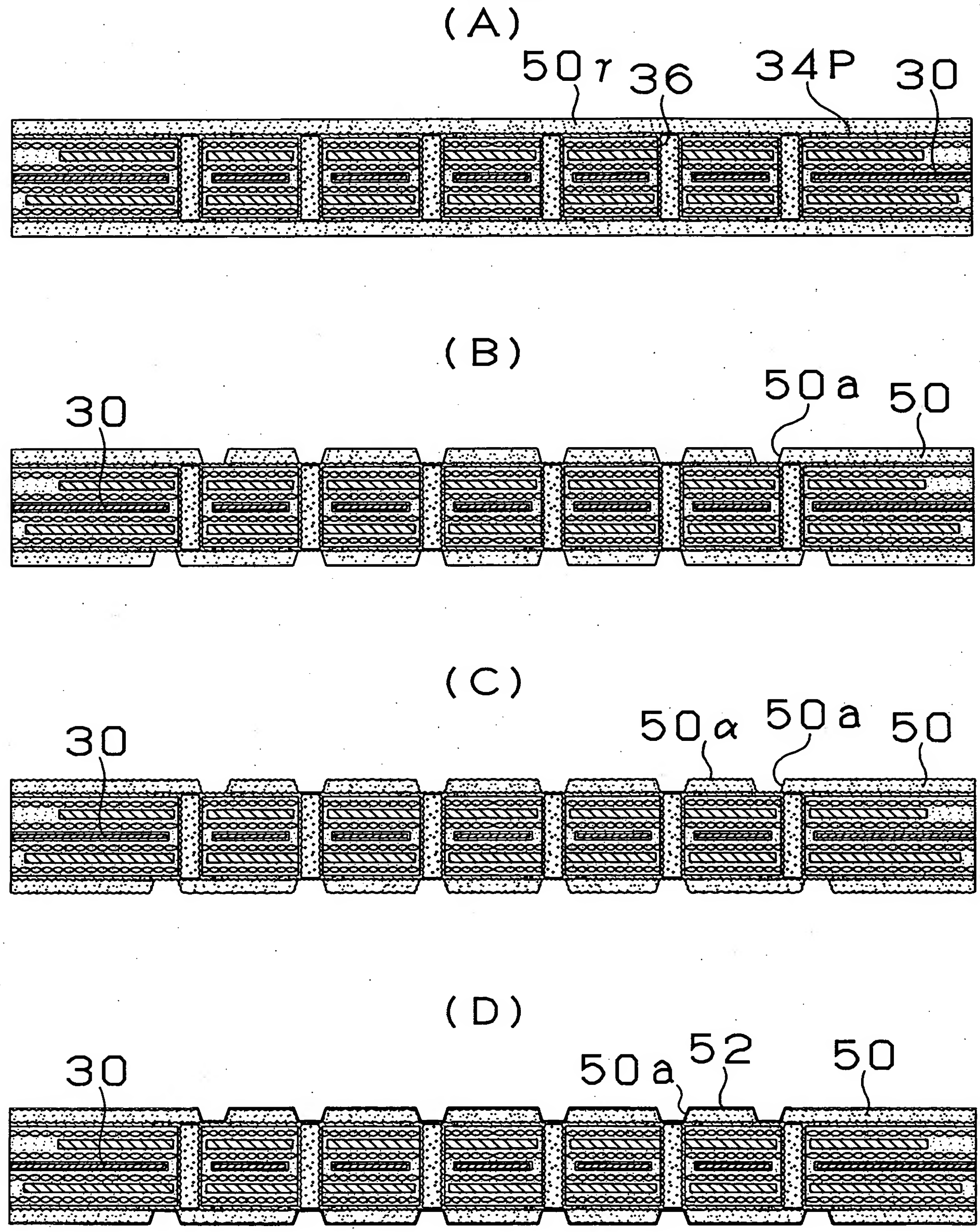


Fig.6

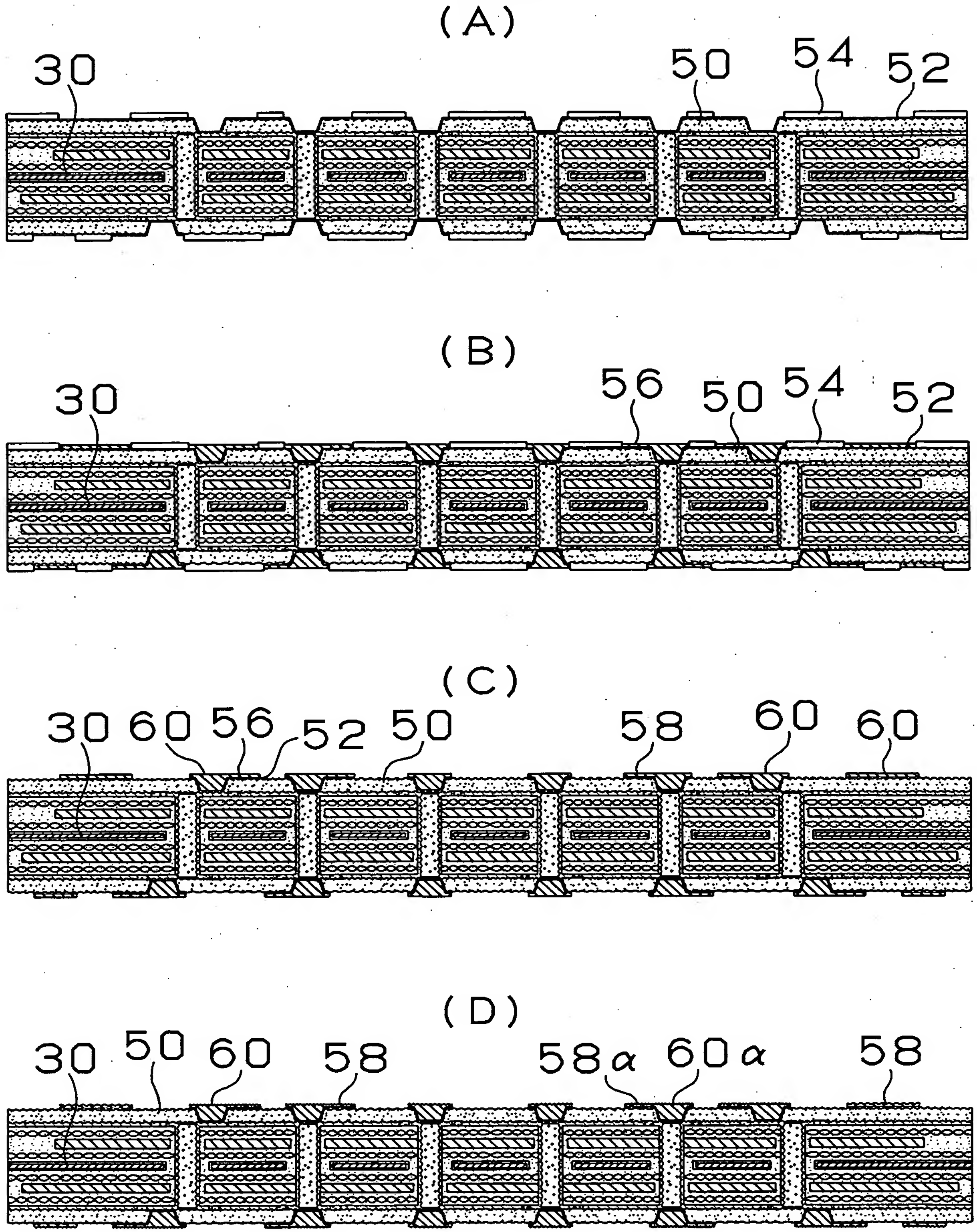

(A)
30
50
54
52
(B)
30
56
50
54
52
(C)
30
60
56
52
50
58
60
60
(D)
30
50
60
58
58α
60α
58

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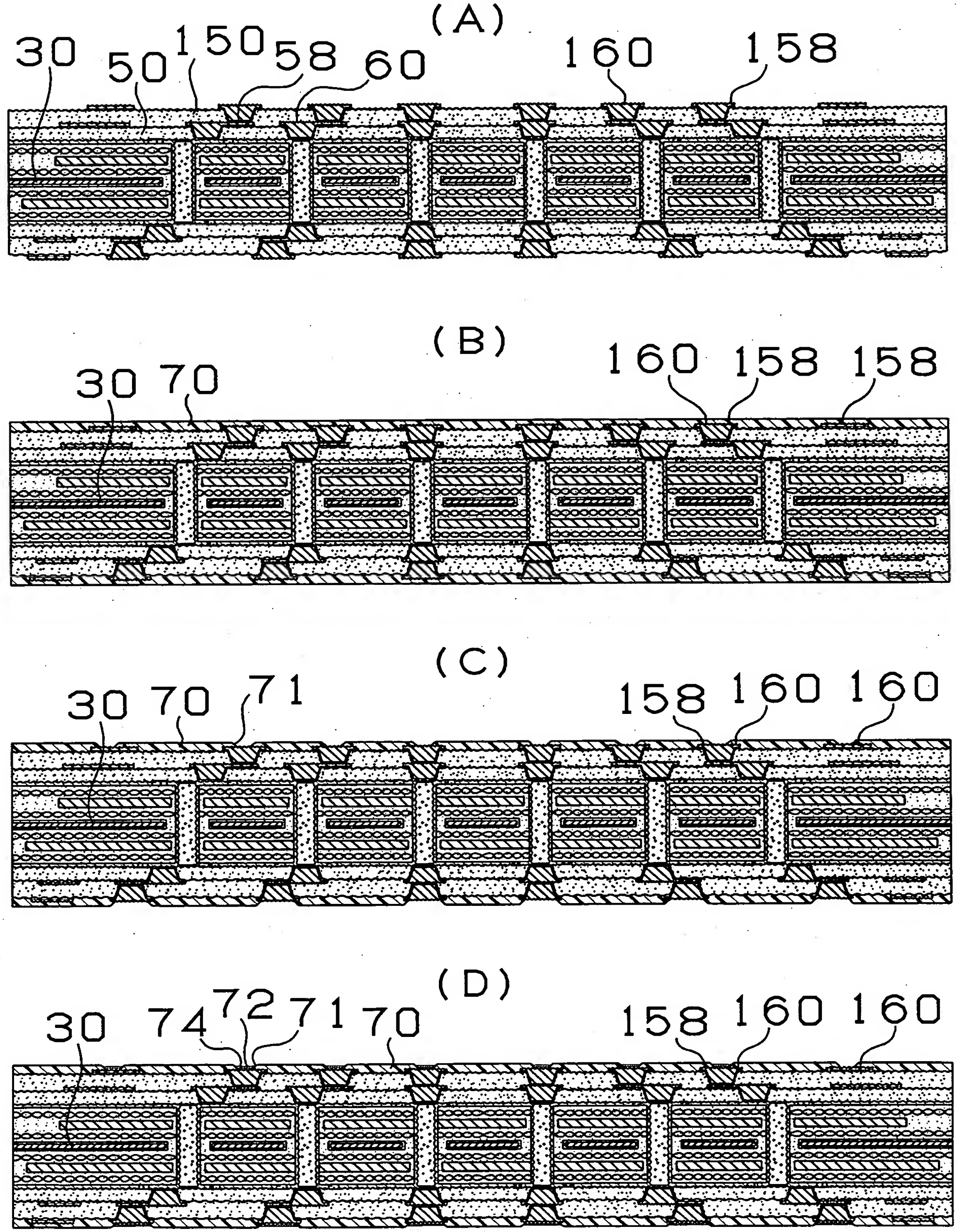
Fig.7



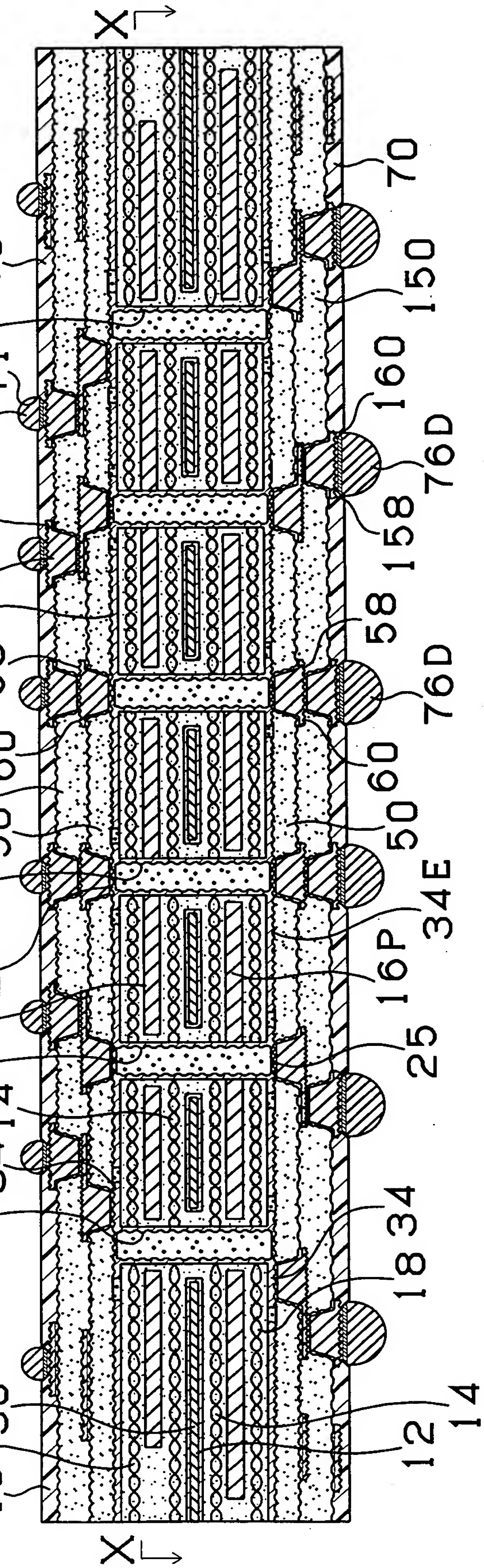

X
70
150
160
76D
158
58
60
50
34E
16P
25
34
18
14
12
36S
71
76U
158
160
34P
58
60
150
50
36E
25
16E
36P
14
34
36S
30
18
10
X

Fig.8

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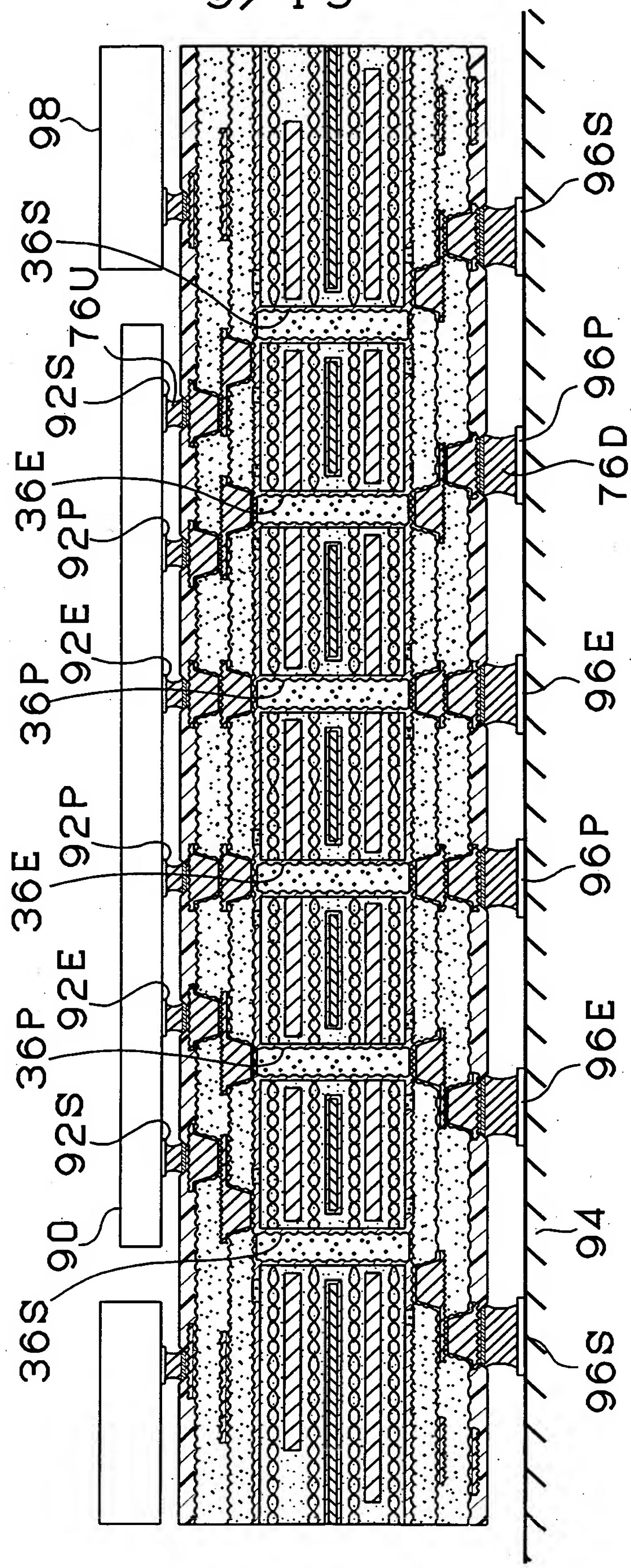
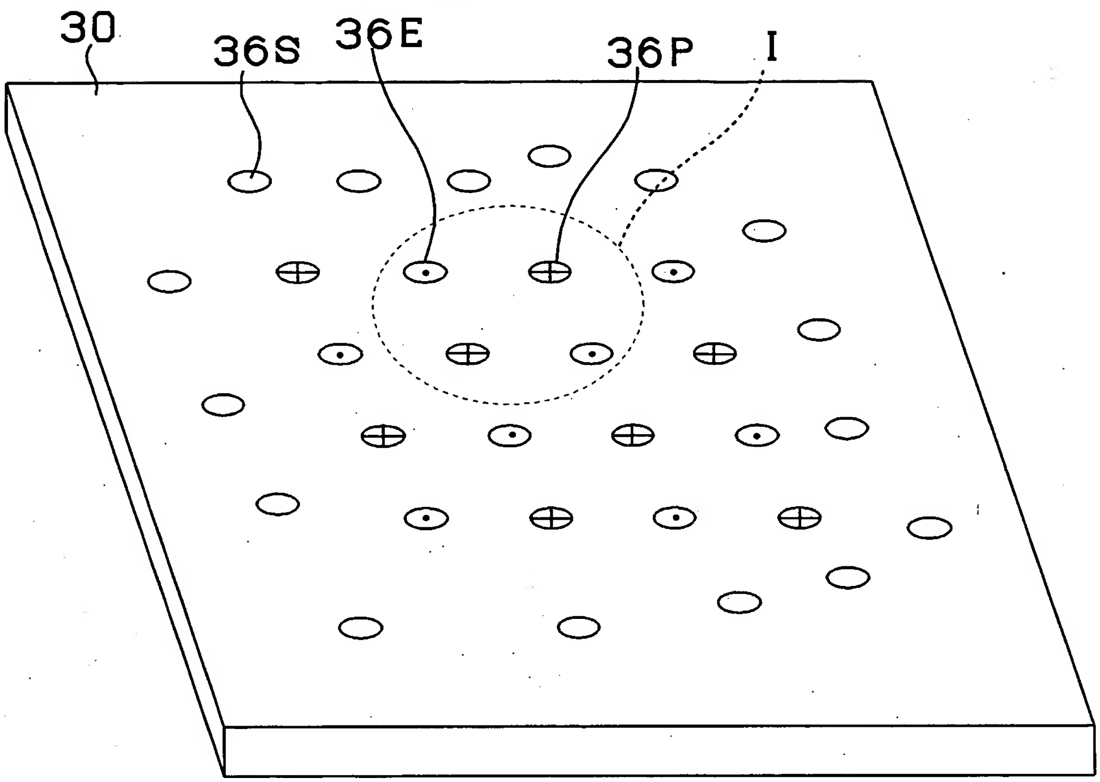


Fig.9

Fig.10

(A)



(B)

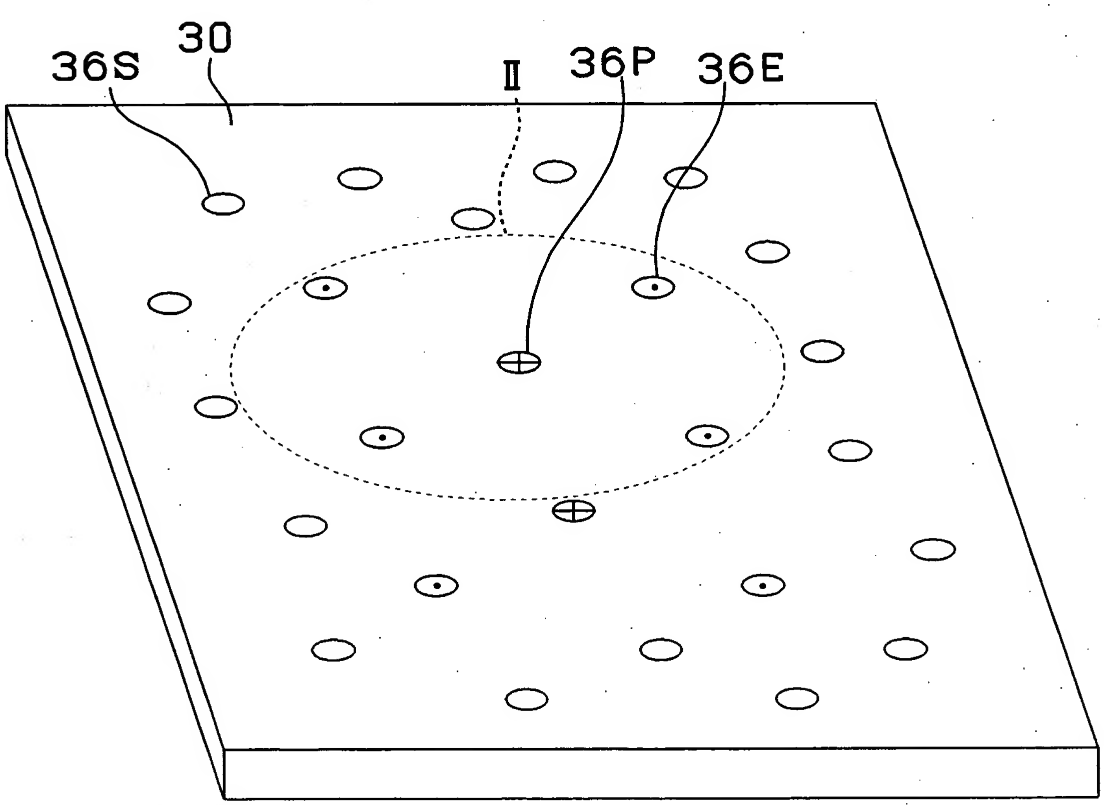


Fig.11

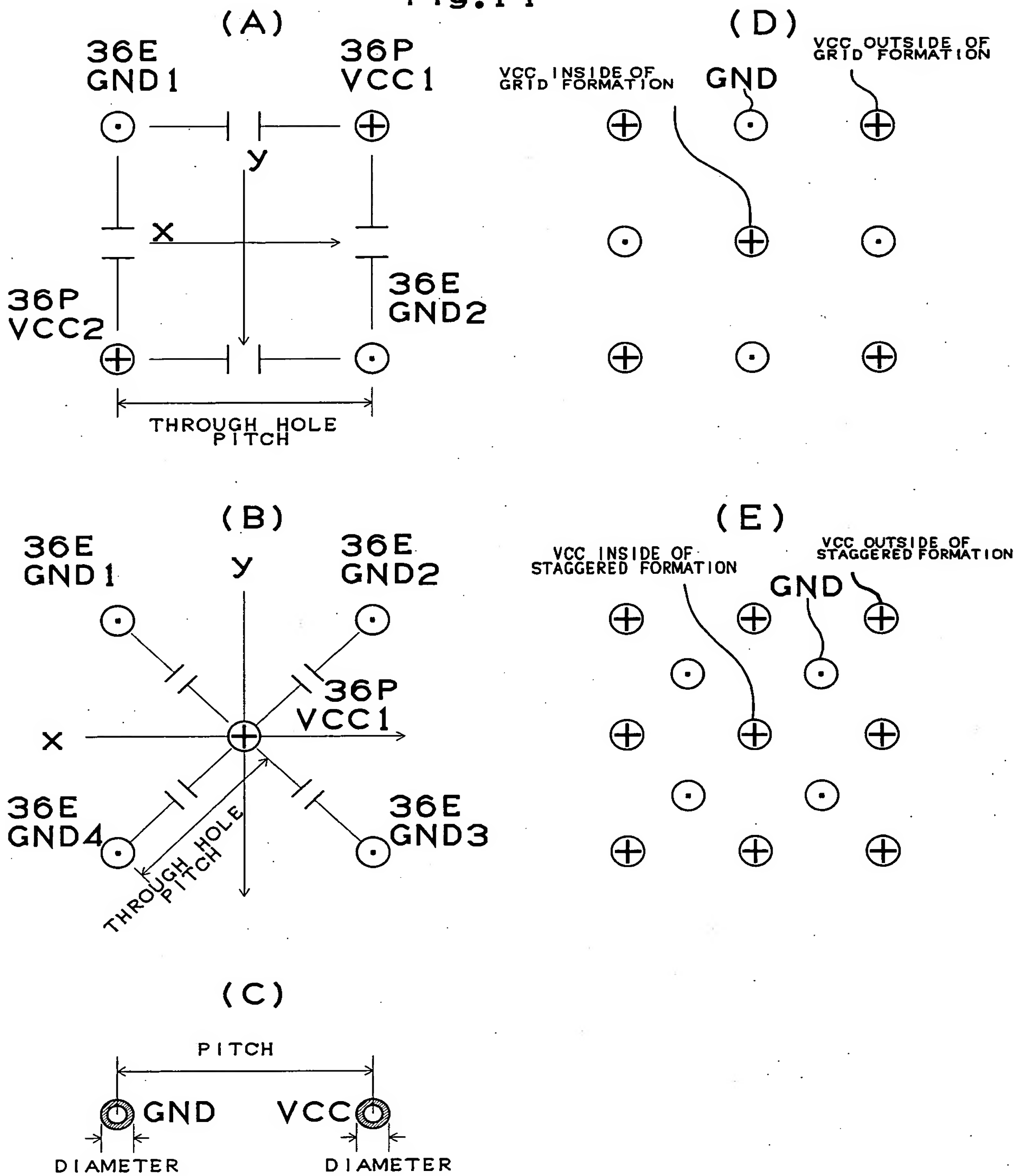

(A)
36E
GND1
36P
VCC1
y
x
36P
VCC2
36E
GND2
THROUGH HOLE PITCH
(B)
36E
GND1
y
36E
GND2
36P
VCC1
x
36E
GND4
36E
GND3
THROUGH HOLE PITCH
(C)
PITCH
GND
VCC
DIAMETER
DIAMETER
(D)
VCC INSIDE OF GRID FORMATION
GND
VCC OUTSIDE OF GRID FORMATION
(E)
VCC INSIDE OF STAGGERED FORMATION
GND
VCC OUTSIDE OF STAGGERED FORMATION

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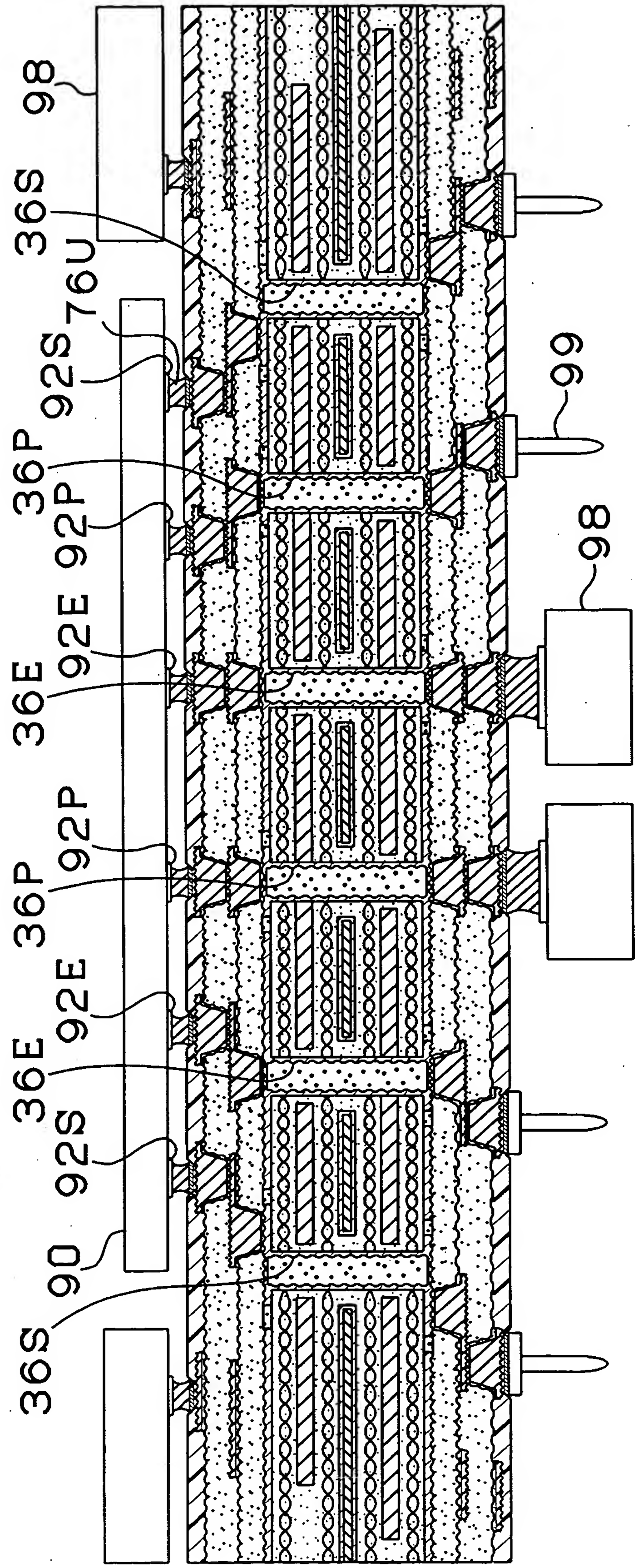
Fig.12



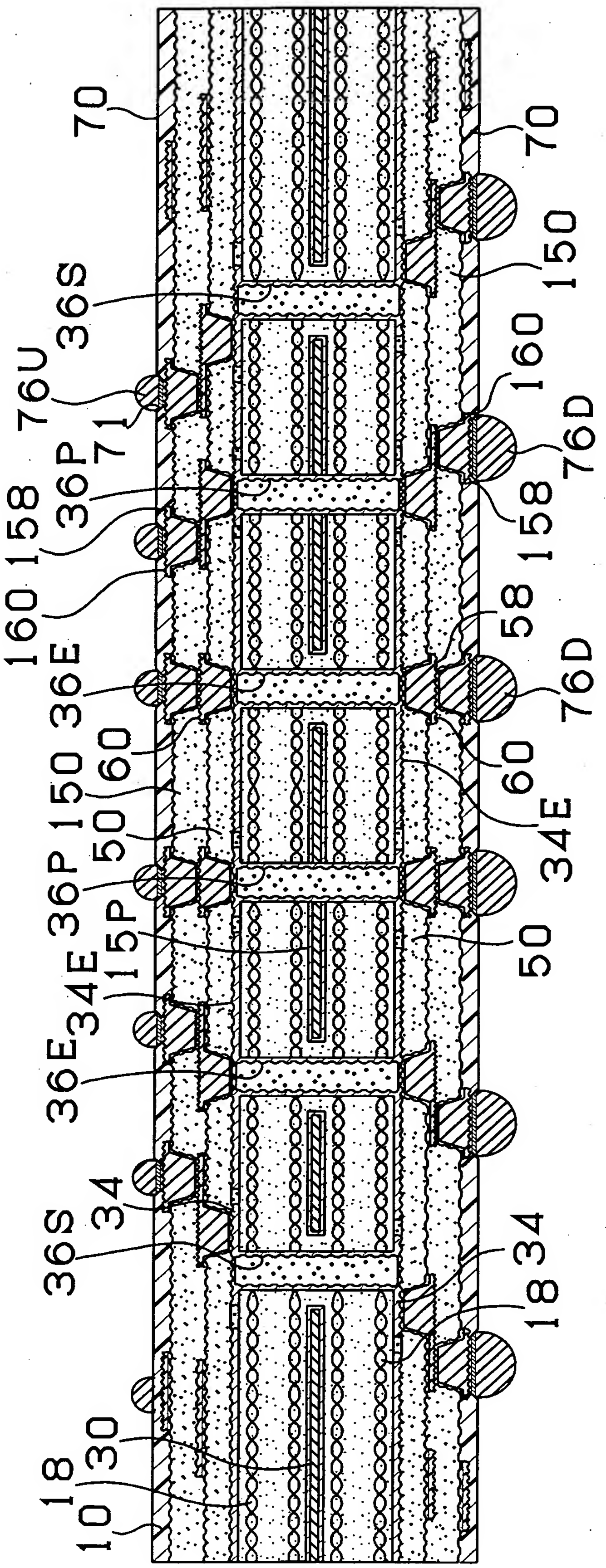

70
70
150
36S
160
76U
71
76D
36P
158
158
160
58
36E
76D
150
60
60
50
34E
36P
50
15P
34E
36E
34
36S
34
18
30
18
10

Fig.13

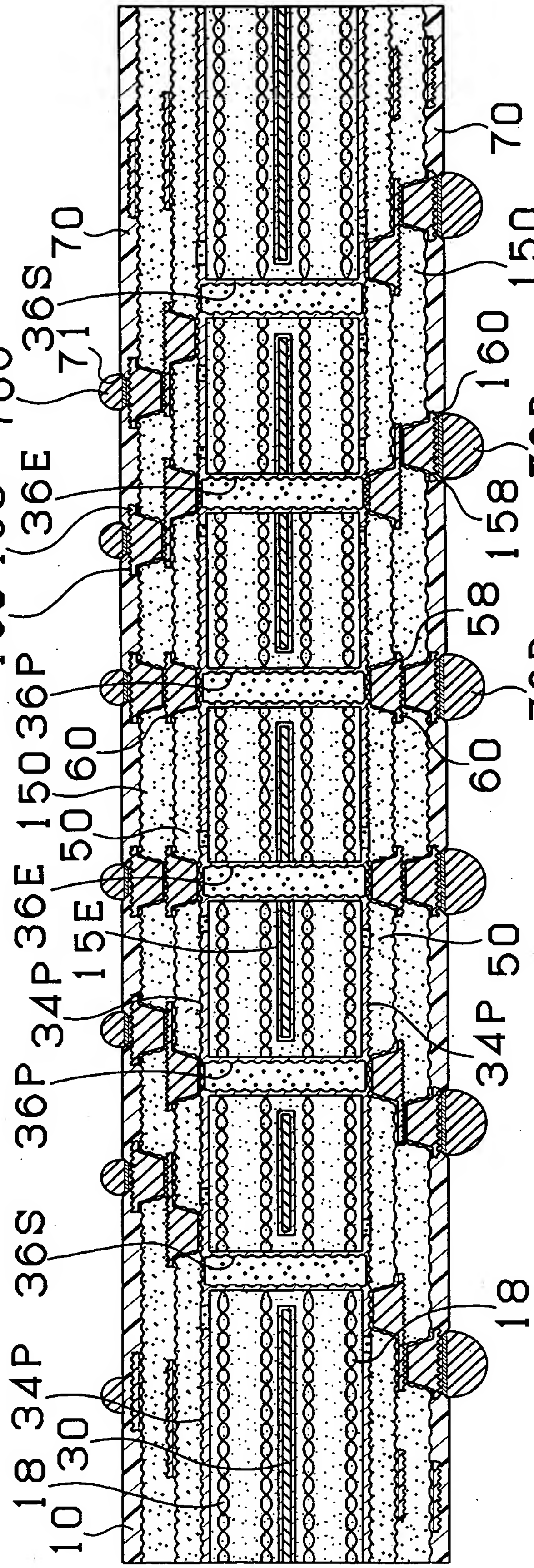

70
36S
71
76U
36E
158
160
36P
150
60
50
15E
34P
18
30
10
150
160
76D
158
58
60
50
34P

Fig.14

10/551439

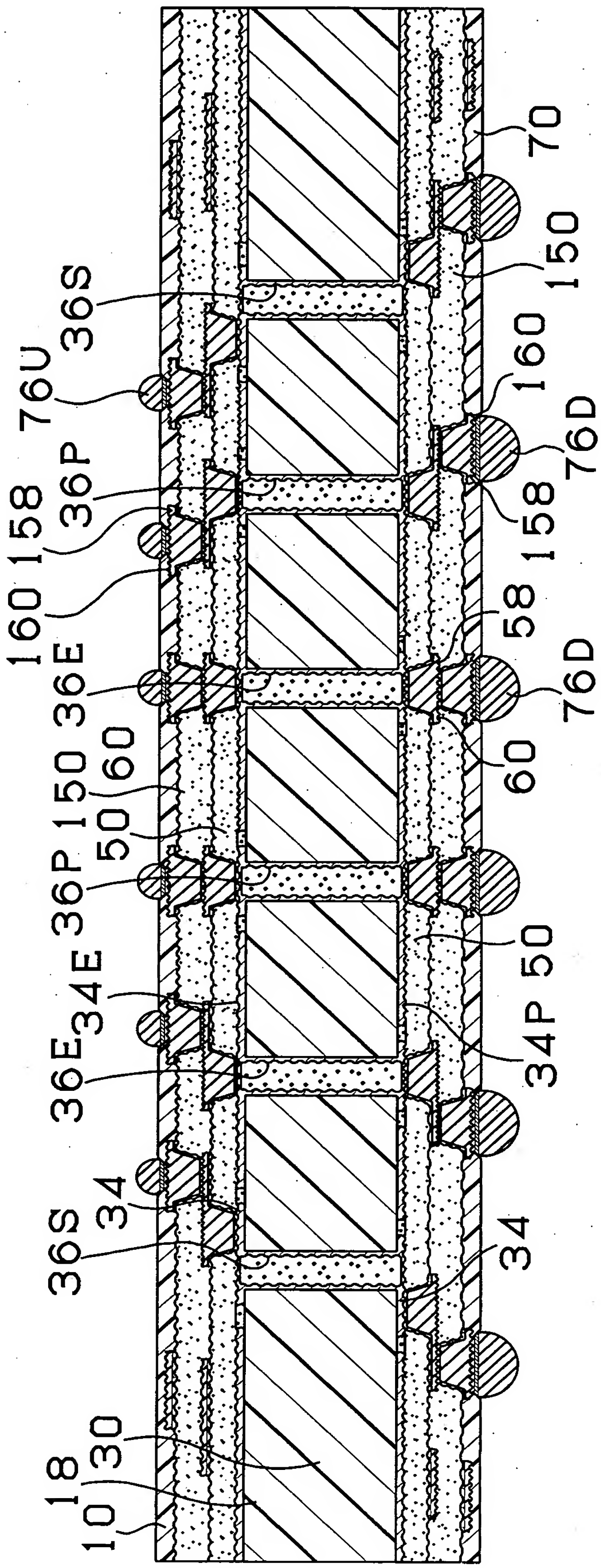


Fig.15

Fig. 16

			STAGGERED FORMATION (THICK COPPER)	GRID FORMATION	RANDOM FORMATION	FOURTH REFERENCE EXAMPLE
THROUGH HOLE PITCH (μm)	THROUGH HOLE DIAMETER (μm)	THICKNESS OF CORE SUBSTRATE (μm)	LOOP INDUCTANCE (pH)	LOOP INDUCTANCE (pH)	LOOP INDUCTANCE (pH)	LOOP INDUCTANCE (pH)
650	450	600	93	84	115	
600	400	600	87	75	109	88
550	350	600	73	59	100	75
500	300	600	73	56	95	75
475	275	600	63	57	90	65
450	250	600	59	55	85	62
425	225	600	58	55	85	60
400	200	600	59	55	—	60
80	50	600	55	50	90	57
50	25	600	63	60	—	

NOTE: A DIFFERENCE BETWEEN FOURTH REFERENCE EXAMPLE AND GRID FORMATION (THICK COPPER) IS JUST A SUM OF THICKNESSES OF CONDUCTIVE LAYERS IN MULTI-LAYER CORE SUBSTRATE.

Fig. 17

(A)

THROUGH HOEL PITCH (μm)	STAGGERED FORMATION (THICK COPPER) CRACK IN INSULATING LAYER	STAGGERED FORMATION (THICK COPPER) RESULT OF CONDUCTIVITY TEST	GRID FORMATION (THICK COPPER) CRACK IN INSULATING LAYER	GRID FORMATION (THICK COPPER) RESULT OF CONDUCTIVITY TEST
650	○	○	○	○
600	○	○	○	○
500	○	○	○	○
400	○	○	○	○
80	○	○	○	○
50	×	×	×	×

CRACK IN INSULATING LAYER : ○ NO CRACK × CRACK

RESULT OF CONDUCTIVITY TEST : ○ NO ABNORMALITY IN RESISTANCE

× ABNORMALITY IN RESISTANCE

(B)

THROUGH HOEL PITCH (μm)	STAGGERED FORMATION LOOP INDUCTANCE (pH)	GRID FORMATION LOOP INDUCTANCE (pH)
650	93	84
600	87	75
550	73	60
500	63	56
475	63	57
450	59	55
425	58	54
400	55	52
350	54	50
300	54	50
200	53	50
100	54	49
75	54	49
60	55	50
50	63	60

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Fig. 18

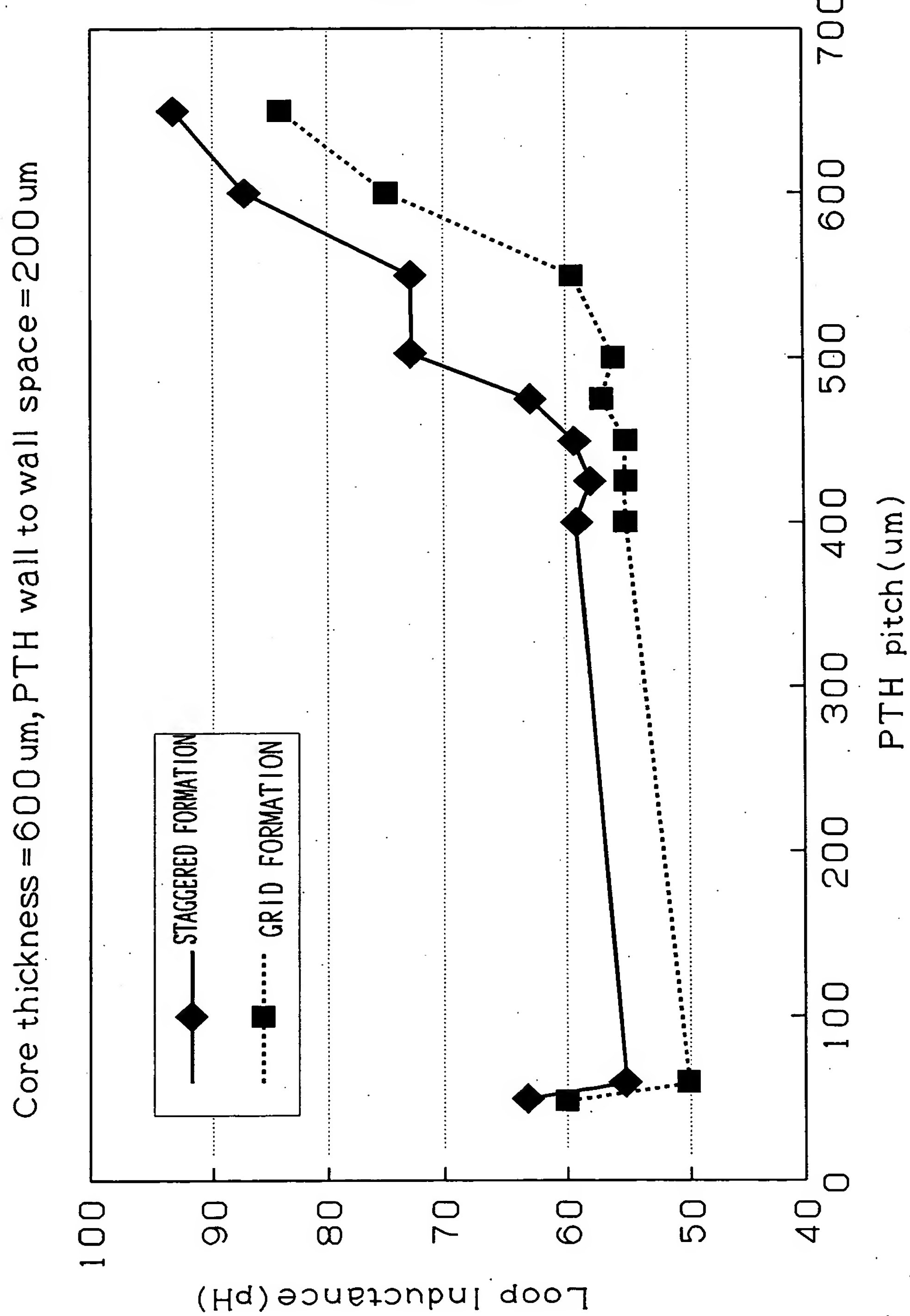

Fig. 19

RATIO OF CORE POWER LAYER